Space Weather Technical Forecast

Issued on Thursday, 17 August 2023 at 01:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of R1/Minor Radio Blackouts throughout. Slight Chance of G1/Minor Geomagnetic Storm conditions on Day 1 (17th). Chance of Active fluence days 3 and 4 (19th and 20th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity, as measured at GOES16, has been Low with only low level C-class flaring observed over the past 24 hours. There are currently nine sunspot regions on the visible disc. AR3403, which has just passed centre disc in the northern hemisphere, is the largest group on the disc, with the main spots increasing in size and their umbrae fragmenting into several smaller spots, but then re-combining again. AR3405 in the far northeast appears to contain a fairly simple magnetic configuration despite its moderate size with no apparent change in appearance. AR3407, in the southeast, has continued to develop and is now the second largest region on the disc. It is also the most complex region, being in beta-gamma magnetic configuration. The other regions are currently small or simple, with no significant changes observed.

No Earth-directed CMEs were observed in the available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as recorded by ACE at L1, was characterised by a possible transient arrival shortly after midday. However wind speeds remained slow, between 270 and 330 km/s. The density has generally been average or below through the period, but with a peak of 10 ppcc at 16/1240 UTC. The IMF was weak, but increased to Moderate from 16/1300 UTC. The north-south component varied weakly between +4/-5nT, but a sustained period of negative BZ was observed 16/1250-1950 UTC, with a peak of -8 nT. The phi angle was mostly variable, but settled on a positive (away from the Sun) orientation from 16/1500 UTC. The net result of the above solar wind parameters was for Quiet to Unsettled geomagnetic activity (Kp 1-3).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels.

GOES16 high energy (greater than 2MeV) electron flux varied between background and moderate levels with the diurnal cycle, peaking at 733pfu at 16/1550 UTC. The associated 24-hour integrated fluence remained below Active (1e8 integrated pfu) on a slight decreasing trend reaching 1.18e7 integrated pfu at 17/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is currently Low, however there is a daily Chance of Moderate activity, with the regions most likely to produce significant flares being AR3403 and AR3407.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently in the forecast. Earth is forecast to be effected by up to two coronal hole high speed streams on days 1 and 2 (17th and 18th). Slightly elevated to elevated solar winds are expected, before declining to ambient levels on days 3 and 4 (19th and 20th). Quiet to Unsettled geomagnetic activity is likely to become Active at times on day 1 (17th), with a slight chance of a G1/Minor Storm interval. Predominantly Quiet activity is expected by days 3 and 4 (19th and 20th).

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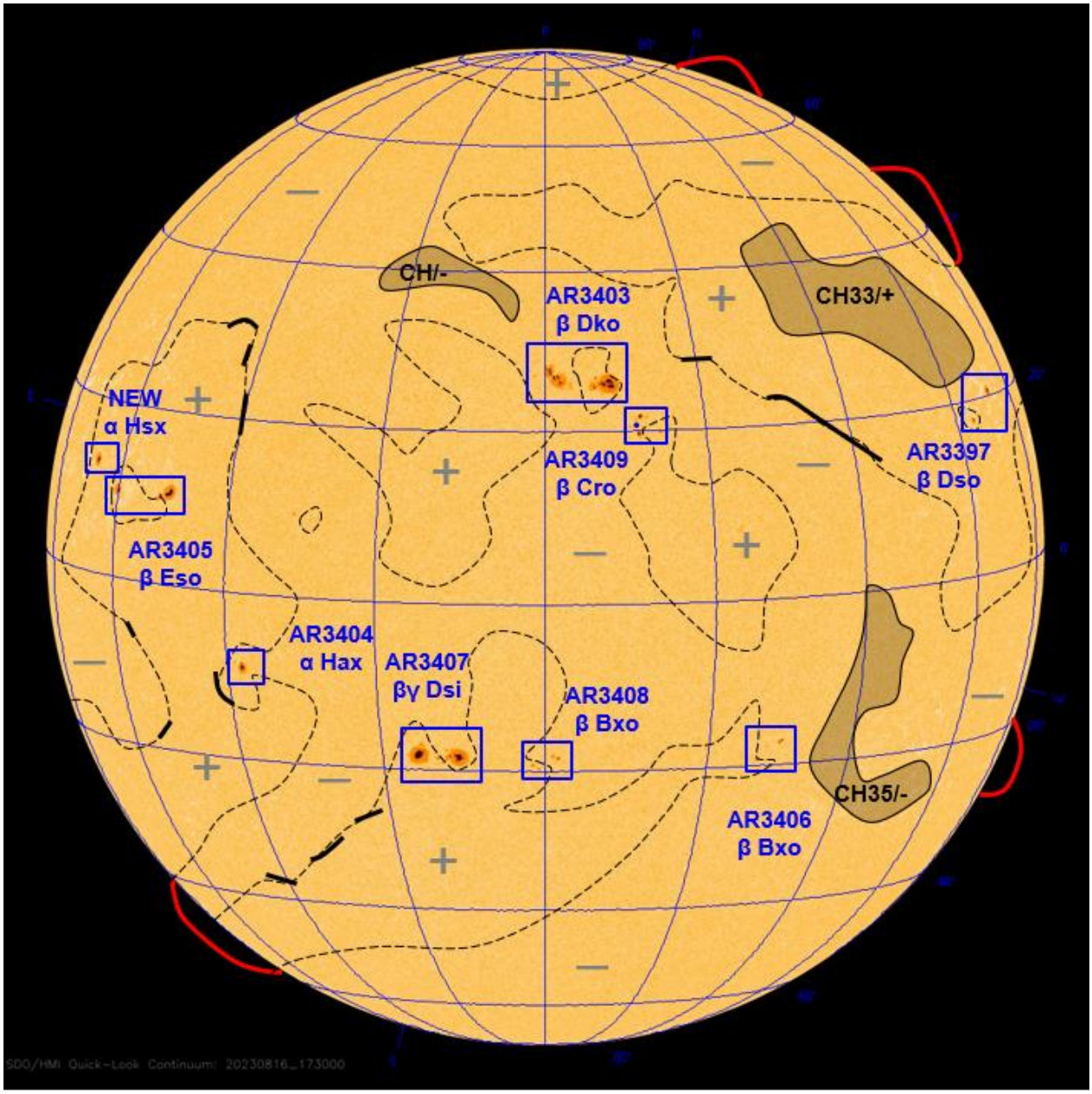
Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to persist at Background.
High energy electron flux (greater than 2MeV) is anticipated to become suppressed upon the arrival of coronal hole fast winds at the start of the period. An increase is expected thereafter, possibly peaking at High levels. Corresponding electron fluence is therefore also likely to rise during the second half of the period, with a chance of exceeding the Active (1e8 integrated pfu threshold) on days 3 and 4 (19th and 20th).

Figure 1. Solar Analysis Valid 16/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

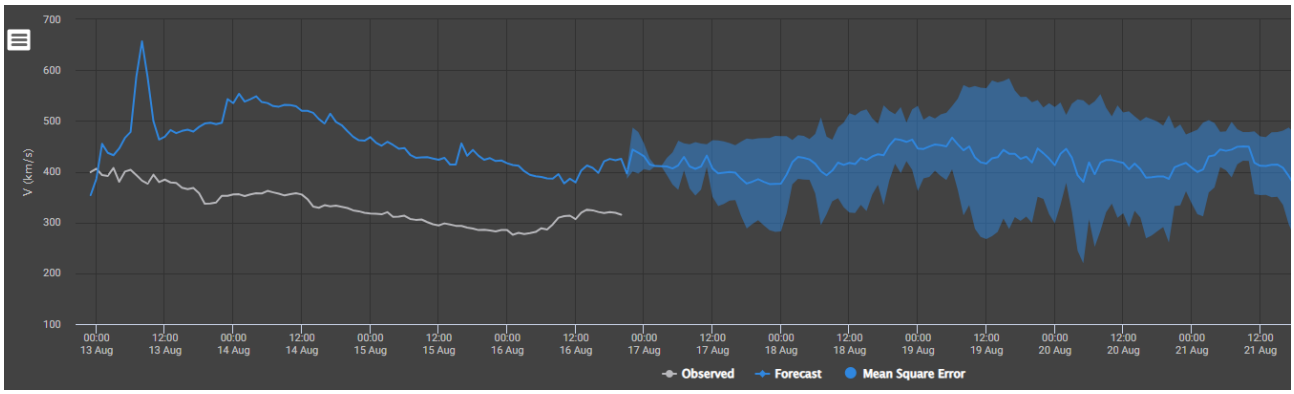
There are no Earth-directed CMEs currently in the forecast.
Current slow-ambient solar wind conditions are likely to undergo an increase during day 1 (17th) due to the influence of high speed streams from CH33/+ and CH35/-. The duration of any fast wind from CH33/+ at Earth is expected to be relatively short, as CH35/- in the southern hemisphere is likely to become dominant. This is of the wrong polarity to generate a significant risk of G1/Minor Storm conditions given the time of year, however it does serve to slightly prolong the small risk from CH33/+ before it. Slightly elevated to elevated wind speeds are likely, before solar winds decline back to ambient levels on days 3 and 4 (19th and 20th). MOSWOC Enlil has been poor in modelling the current wind speeds, with Enlil suggesting we should have been in a HSS for at least the last 48 hours. As such it is not considered to be giving good guidance at present.
Quiet to Unsettled geomagnetic activity is likely to become Active at times on day 1 (17th), with a slight chance of a G1/Minor Storm interval. Activity is likely to reduce on day 2 (18th) to become predominantly Quiet by days 3 and 4 (19th and 20th).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil

Figure 2: MOSWOC Solar wind persistence model



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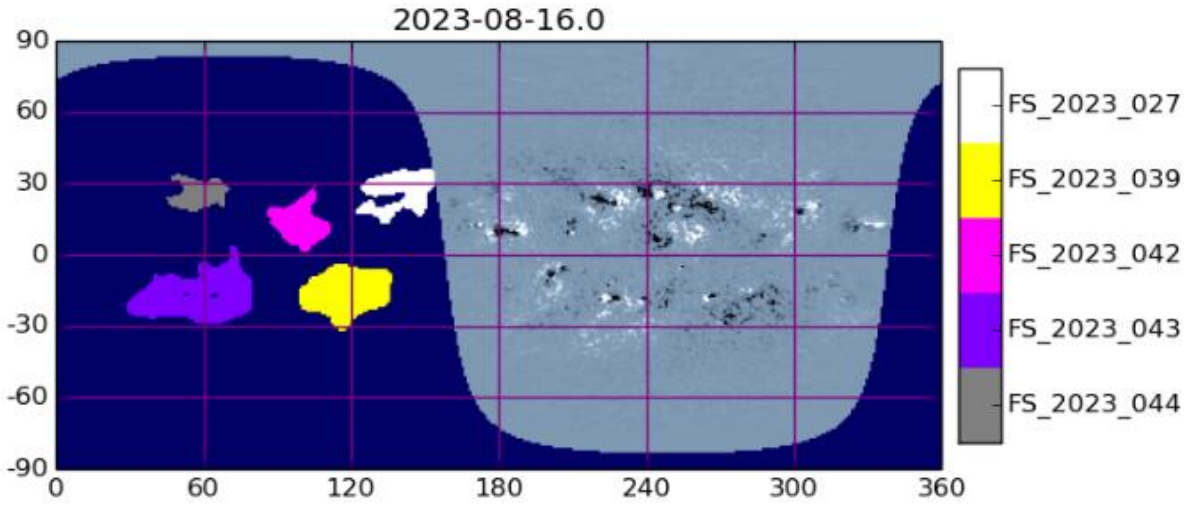
Radio Blackouts - X-Ray Flares:

Solar activity is currently Low, however there is a daily Chance of Moderate activity, with the regions most likely to produce significant flares being AR3403 (Dko/Beta) and AR3407 (Dsi/Beta-Gamma).
There are nine sunspot regions presently on the visible disc. AR3403 (Dko/Beta), in the north centre disc, is the largest, but has remained relatively quiet, with no significant changes. The next largest spot is now AR3407, in the southeast, which has seen continued growth of its penumbra. This is also the most complex region on the disc, being in Beta-Gamma formation. AR3405, in the northeast, is of note, being of moderate size, However it retains a simple magnetic structure. All other spots are currently small or simple, with no significant development observed.
Regarding the balance of sunspot group numbers, AR3397 leaves the disc on day 2 (18th), meanwhile there are signs from far sided products that a couple of regions may arrive over the eastern limb over the next couple of days to mitigate this. Overall therefore, the flare risk is held constant.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	2	2	2	2

Figure 3: Far-sided soundings



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Solar Radiation Storms - (High Energy Protons):

The flux of high energy protons (greater than 10 MeV) is at Background. It is expected to remain at this level through the period, however there is a very slight chance of a >S1 event as the larger and more complex regions on the visible disc move across centre disc into the western hemisphere over the coming days.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

In recent days the high energy (greater than 2 MeV) electron flux at GOES16 has been varying between Normal Background and diurnal peaks of High (above 1000pfu). However, on the 15th and 16th August a diurnal peak of Moderate was observed and with the onset of two high-speed streams forecast on Day 1 (17th) any periods of High flux are considered very unlikely as electron counts at GEO are suppressed for a time. Confidence in the intervening time period is lower - due to the uncertain timing and duration of the fast winds from CH33/+ and CH35/-. However, flux levels are likely to rebound from day 2 (18th), possibly reaching High values once again. The corresponding fluence is therefore also likely to rise during the second half of the period, with a chance of exceeding the Active (1e8 integrated pfu threshold) on days 3 and 4 (19th and 20th).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	10	30	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: GOES16 electron flux (3days)

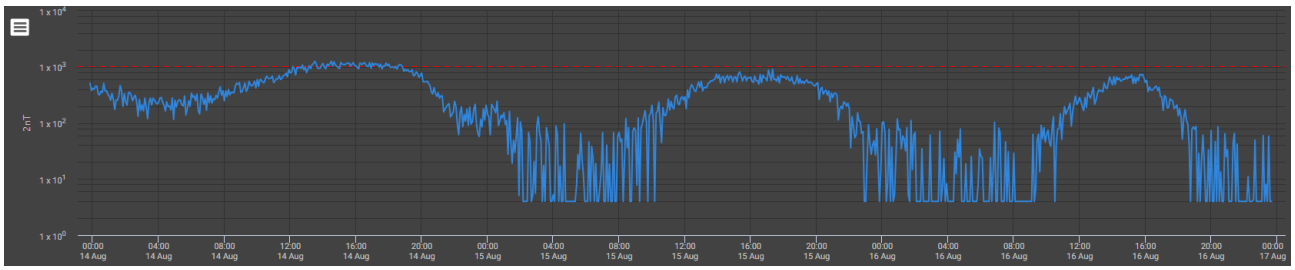

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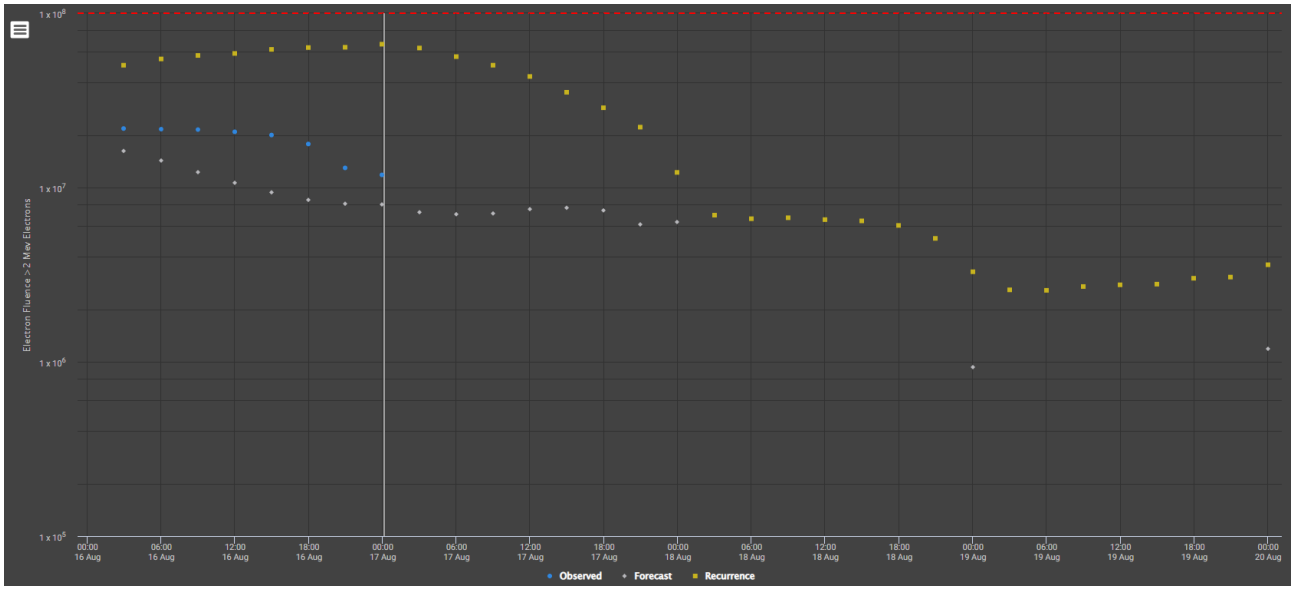
Figure 5: GOES16 electron fluence and REFM data



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